International Journal of Agricultural
Science and Research (IJASR)
ISSN (P): 2250–0057; ISSN (E): 2321–0087
Vol. 11, Issue 2, Dec 2021, 115–128

TRANS STELLAR
• Journal Publications • Research Consultancy

INDIA'S TRADE INTEGRATION WITH TOP MUSHROOM EXPORTING COUNTRIES: APRAGMATIC ANALYSIS BY A PANEL DYNAMIC GRAVITY MODEL

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Abstract

Background: Mushroom market has expanded both horizontally and vertically all over the globe, this means that the expansion has been in producing and adding new types of fungi for the commercial cultivation of edible Fungi. The global market for edible mushrooms is expected to grow from 2019 to 2024 with a market value of $37.46 billion by the end of 2024. Currently, the total Indian mushroom production is about 0.13 million tonnes from 2010 to 2017, the Indian mushroom sector registered an average annual growth rate of 4.3%.

Results: The global mushroom industry has grown rapidly over the last number of years, the strongest growth observed in the dried form of mushrooms followed by preserved, fresh and frozen mushrooms. China is on top with 74.11 % share in global mushroom production from last 10 years and India is far behind with only 0.68 % share of global production. India producing 73 % button mushroom, 16 % oyster, 7% paddy, 3 % milky and 1% other mushrooms. In 2018-19 Haryana has highest production in India followed by Odessa, Maharashtra and HP. Mushroom cultivation is a profitable business with B:C ratio 1:1.6 and has scope for start-up or entrepreneurship. There is huge opportunity in export of mushroom, India export mushroom to USA, Germany, France, Israel and other many countries and Delhi has highest share in export.

Conclusion: Gravity model suggested that India export only those countries which have high GDP whereas distance is not the barrier of high cost in trade. High unemployment rate and 50% plant and food waste created opportunity to generate employment. Processed mushrooms and value added products in blended form give the essence of tradition, nutrition and taste.

KEYWORDS: Edible Mushroom, Gravity model, Value edition, Employment, Entrepreneurship

Received: May 18, 2021; **Accepted**: Jun 08, 2021; **Published**: Jul 12, 2021; **Paper Id.**: IJASRDEC202113

Original Article

1. INTRODUCTION

According to Food and Agriculture Organization (FAO) Mushrooms have been recognized as food item and Contribute to nutritional proteins in developing countries, such as India, which relies heavily on grain diets. India's current agricultural scenario needs to emerge as a global economic outlaw in terms of agricultural productivity through the adaptation of new technologies leading to global economic strength. In India commonly cultivated species are white button mushroom, oyster, shiitake mushrooms and other mushrooms cultivated in small scale are paddy straw, milky and reishi mushrooms. Button mushroom accounts for about 95 per cent of total production and exports. The Button mushroom grows in the temperate regions of Himachal Pradesh, Jammu and Kashmir. Mushroom production now popular as a commercial and trade-oriented activity. The major export destinations for

Indian mushrooms are Canada, the United States, Israel and Mexico. Mushrooms are exported in two formats: fresh mushrooms and canned or processed mushrooms. There has been a significant increase in demand for processing fungi in recent years. They may be canned, dried, frozen, and packaged, including their use in the food industry in mushroom pickles and sauces. To attract investment in technology India's FDI policy need to produce and develop mushrooms under controlled conditions (National Horticulture Board annual report 2017-2018). The Government of India is working to encourage mushroom growers to develop advanced R&D technologies and policies it plays a vital role in the process of selecting mushrooms and optimizing the growing environment to improve performance. Such advancements in technology and favourable government initiatives promise many opportunities for growth for industry participants and mushroom researchers. (J. Mushrooms December, 2018).

2. GLOBAL AND INDIAN PROSPECT OF MUSHROOM MARKET

2.1. Global Prospect of Mushroom Production

The mushroom production market is estimated to have a value of USD 16.7 billion in 2020 and expected to grow at a 4.0% CAGR from 2020 to reach USD 20.4 billion by 2025. The world market in mushrooms is expected to grow strongly due to factors such as the multiple health benefits of mushrooms, increased consumption of mushrooms per capita, cost-effective production, and increased demand for vegan and natural foods in the diet and rising global health-conscious populations are some of the main drivers driving demand for mushroom production (Markets and Markets report).

Table 1: Global Mushroom Production: Top 10 Countries

Production in (000) MT(2018)			
Rank	**Country**	**Production**	**Share(%)**
1	China P Rp	6,664.61	74.11
2	U S A	416.05	4.63
3	Netherland	300	3.34
4	Poland	280.23	3.12
5	Spain	166.25	1.85
6	Canada	138.41	1.54
7	U K	98.5	1.1
8	France	83.01	0.92
9	Iran	81.41	0.91
10	Germany	73.23	0.81
11	Others	691.6	7.67
	Total	**8,993.30**	**100**
14	**India**	**60.73**	**0.68**

Source: Food & Agricultural Organisation (FAO)

The China Business Research Institute has identified the country as the largest producer of edible mushrooms. Globally, it achieved an estimated annual yield of 6,664.61 million tonnes in 2018. This represented about 74.11% of total production and India was 60.73 million tonnes, which represented only about 0.68%. A study revealed that mushroom growing is the fifth largest agricultural sector in the country, valued at $24.0 billion. The second most important mushroom-growing country is the United States, followed by some European countries. European output is concentrated in France, Germany, the Netherlands, Italy and other Western European countries. Asia-Pacific is the number one region in the global mushroom industry. China, the world's largest producer of mushrooms, consumes more per capita than any other country. The consumption of mushrooms in Asian countries such as Japan, India and other countries is increasing at a

clearly recognized rate by increasing output. The growth of the vegan population and the shift towards nutritious foods has led to the growth of the mushroom market in Asian countries.

China consistently on 1st position in production from 2010 to 2020 and other countries rank can see in table 2. Indian production rank 9th in year 2016 and 2017 and UK consistently increasing production.

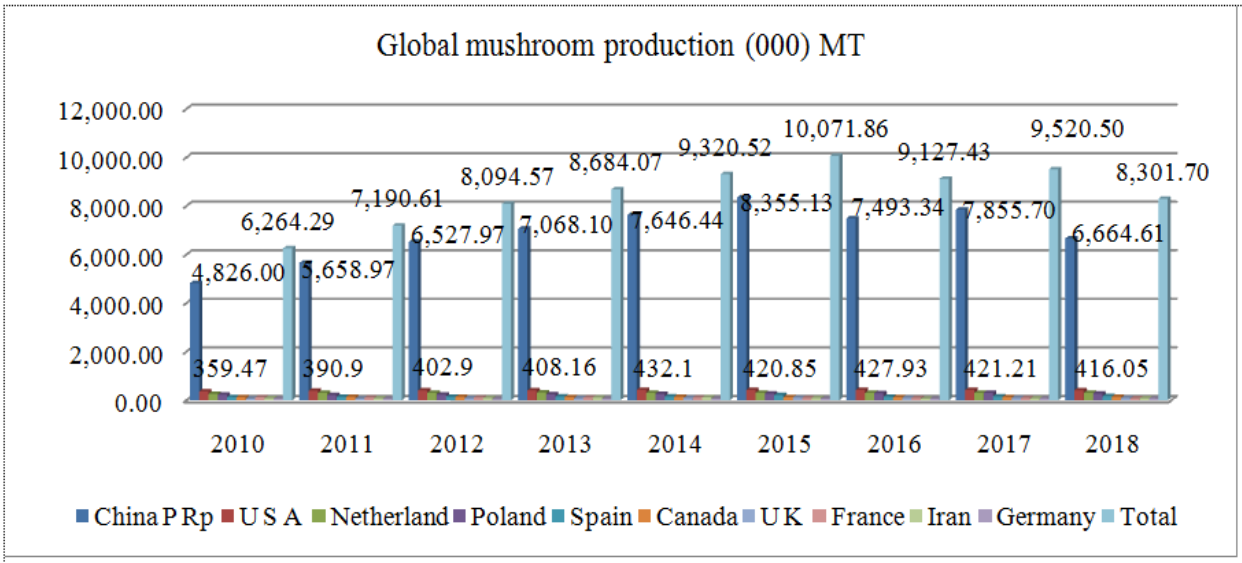
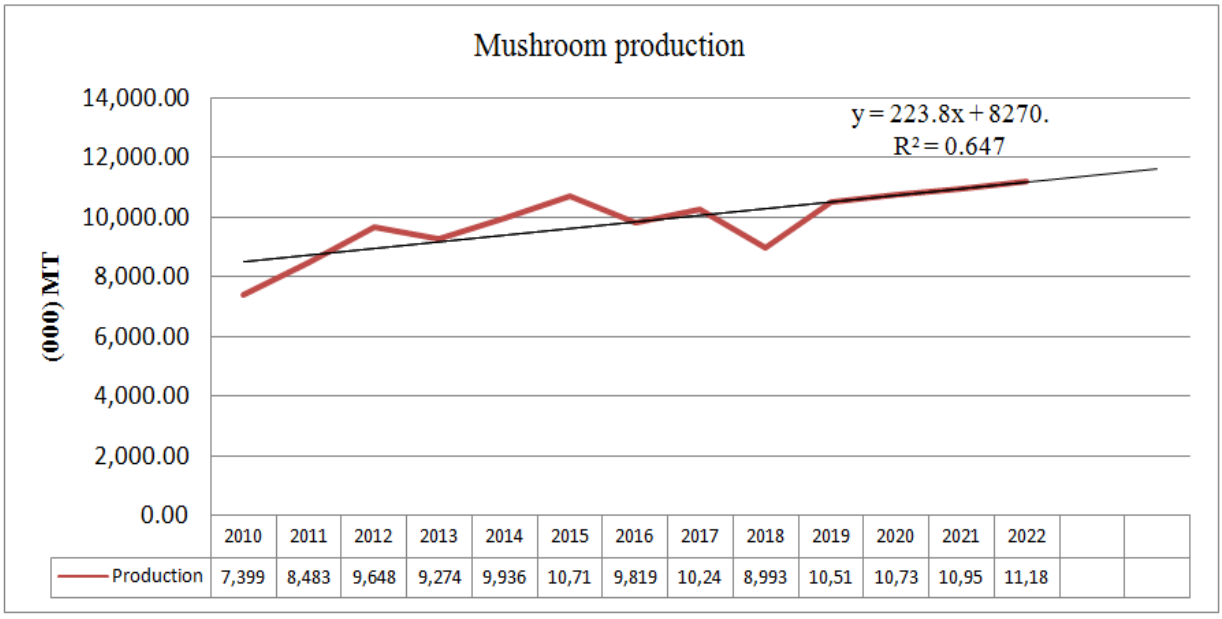


Figure 1: Global Mushroom Production in Different Countries from 2010 to 2018

In figure 2 on the basis of trend line analysis we analysed that global mushroom production will reach at 11,181 thousand million tone in year 2022. Regression equation provides total variance which is 64% of production data forecasting.

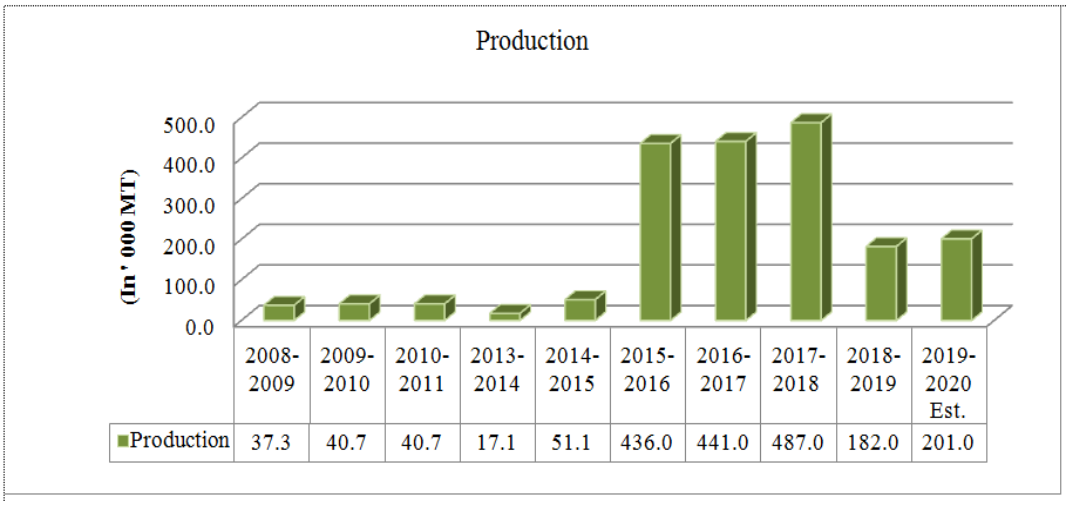


Source: Researcher's own compilation of data from APEDA

Figure 2: Trend line analysis global mushroom production

2.2. Indian Prospect of Mushroom Production

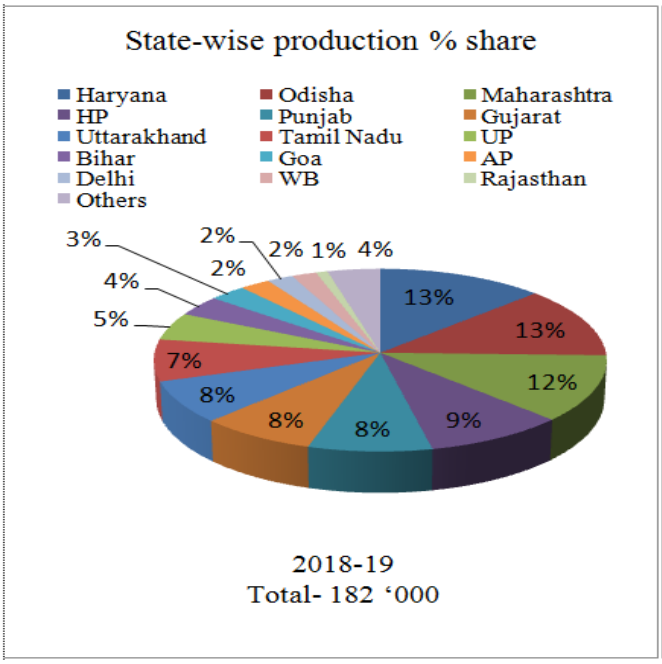
According to government data, in 2013-14, India produced 17,100 metric tonnes of mushrooms, and in 2018, that number increased to 4,87,000 metric tonnes (about 29 times in four years). However, India represents only about 2% of the world production of mushrooms, the lion's share being with China which represents more than 75% of the world production.

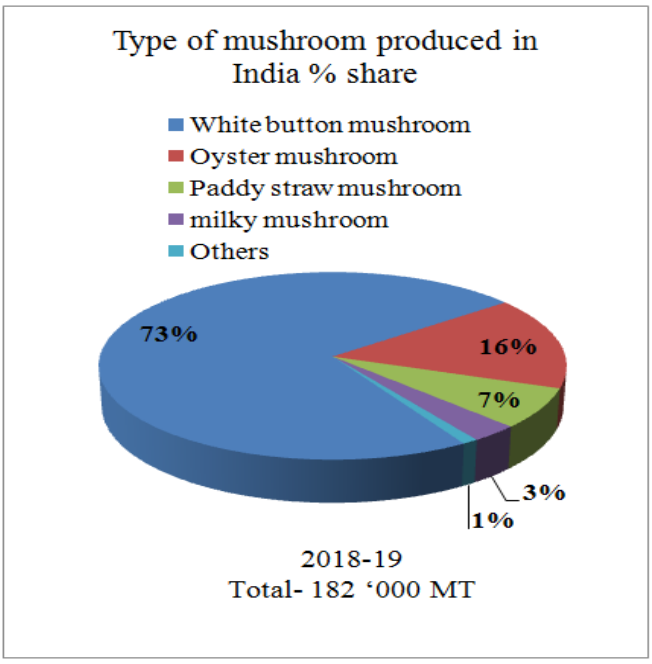


Source: Ministry of Agriculture and Farm Welfare, Government of India

Figure 3: Indian mushroom production from 2008-09 to 2019-20(Estimated)

According to indiastat.com Haryana produces 20.05 thousand tons which is highest production in year 2017-18 and followed by Odisha, Maharashtra, Himachal Pradesh, Punjab etc. (fig.4) are the major producing states in India. In fig.5 White button mushroom share 73% of production in different type of mushroom followed by Oyster, Paddy straw and milky mushroom.





Source: Annual Report of Ministry of Agriculture and Farmers Welfare

Figure: 4 State wise production share in per cent **Figure. 5 Type of mushroom produced in India share in %**

2.3. Export

According to FAO data, the three major mushroom-producing countries are China, the United States and the Netherlands, which account for over 60% of world production. World exports of processed (dried and canned) mushrooms continue to increase from 0.04 to 0.68 million tonnes in last four decades (1970-2010). Compared with the export of fresh mushrooms (0.014-0.482 million tonnes), but export fluctuations are higher for the processed mushroom. The UNFCCC Edible Mushrooms Directorate (2018) reported that exports of edible mushrooms were valued at $3.8 billion in the same year.

Over the past three years, the largest growth has been in the export of dried mushrooms from India, followed by growth of 20.82% in canned mushrooms and 15.96% in other species, Then there was Agaricus spp. and 9.67 % fresh or frozen mushrooms (Table 2).

Table 2: Indian Processed (Fresh, Frozen, Dried and Canned) Mushroom Export

								Qty in MT Value in Million US$
		2016		2017		2018		% growth
Sr. No.	Category	Qty	Value	Qty	Value	Qty	Value	
1	Fresh Mushroom/Frozen Mushroom	370.36	833.25	373.01	886.92	376.32	972.72	9.67
	Mushrooms other than of the genus agaricus, fresh/chilled	155.5	541.38	146.17	574.57	147.68	666.3	15.96
2	Dried Mushroom	9.02	60.93	8.66	59.13	10.56	99.83	68.83
3	Canned Mushroom	303.64	490.31	347.26	503.21	400.43	608	20.82
	Mushrooms other than of the genus agaricus, prepd./presvd.	79.5	167.11	68.65	153.09	61.17	156.32	2.11
	Mushrooms of the genus agaricus, provisionally presvd.	15.88	26.52	20.32	39.54	16.85	30.94	-21.75
	Mushrooms other than of the genus agaricus, provisionally presvd.	23.58	59.41	20.12	49.8	21.33	52.44	5.3

Source- Researcher's own compilation of data from APEDA

Top export destinations of edible mushroom are USA, Switzerland, France Germany and China (Table 3). Here we can see the export pattern in terms of quantity and value from year 2011-12 to 2020-21 estimated.

Table 3: Top Edible Mushroom Export Destinations from 2011-12 to 2020-21(April-September)
Quantity in Million Tonnes Value in US$ MM

Country	2011-12		2012-13		2013-14		2014-15		2015-16		2016-17		2017-18		2018-19		2019-20		2020-21 (April-September)	
U S A	18183.24	27.13	3223.49	4.98	1364.78	3.35	399.16	1.21	203.69	0.81	482.22	1.53	255.11	0.52	306.22	0.63	153.1	0.28	8.23	0.04
Switzerland	28.79	4.63	10.34	2.72	17.18	4.17	30.82	7.93	29.36	4.13	32.3	3.56	20.02	2.12	10.5	0.29	8.22	0.11	0.04	0.01
France	13.6	2	3.97	1.09	11.6	2.31	35.59	8.84	38.3	6.63	30.63	3.84	7.63	1.29	3.21	0.39	2.43	0.24	1.79	0.11
Germany	43.29	1.57	25.07	1	71.82	1.94	93.92	2.15	134.68	2.45	135.99	2.73	119.01	2.52	113.49	2.23	88.95	1.41	19.04	0.6
China P Rp	1.58	0.19	3.08	0.76	2.27	0.45	12.57	3.04	3.24	0.67	2.25	0.18	0.14	0.02	0.1	0.02	0.22	0	0	0
Israel	636.92	0.6	1207.06	1.64	370.36	0.51	0.12	0	1.24	0.05	0.73	0.03	0.7	0.03	0.68	0.03	0.12	0	0.1	0
Russia	478.94	0.59	1404.38	1.44	213.1	0.37	100	0.09	1.64	0.03	0	0	0	0	0	0	0	0	0.07	0
Hong Kong	1.61	0.07	17.41	0.14	2.92	0.53	10.1	0.02	0.83	0.18	2.43	0.33	2.5	0.49	1.75	0.28	0.82	0.13	2.15	0.05
Maldives	0.48	0	113.47	0.16	548.9	0.78	713.08	0.88	140.38	0.17	86.01	0.11	1.31	0	1.6	0	0	0	0	0
Mexico	778.55	0.92	805.08	0.83	40	0.09	4.03	0.08	0	0	0	0	0	0	12.2	0.03	0	0	0	0

Source- Researcher's own compilation of data from APEDA

2.3.1. Export of Mushroom: Chinavs. India

When we compared the export status of China and India, we saw that the exports of different categories of mushrooms from China are also very abundant. In table 5 compared china export with Indian export for 3 years the

export potential for all mentioned categories is very high in china for year 2018 and Indian export found far behind in last three years from 2017-18 to 2019-20.

Table 4: Export of Mushroom: China vs. India

			China		India					
			2018		2017-18		2018-19		2019-20	
S.No.	Product	HS Code	Quantity in MT	Value in Mill. US$	Qty In MT	Rs. Crore	Qty In MT	Rs. Crore	Qty In MT	Rs. Crore
1	Mushroomsdried but not further prepared	7123100	8,187.77	81.7	77.8	30.77	69.47	20.95	39.48	12.05
2	Other truffles fresh or chilled	7095900	55,943.52	157.15	421.75	4.58	1110.64	6.2	246.43	4.21
3	Mushrooms of the gensusagaricus, provisionally preserved	7115100	11,855.81	18.88	5.13	0.15	25.8	0.23	136.25	1.78
4	Other mushrooms & truffles provisionally preserved	7115900	15,324.39	37.93	485.78	6.05	391.81	5.45	120.08	1.65
5	Mushrooms of the genus agaricus, fresh/chilled	7095100	21,289.61	34.59	15.54	0.25	291.33	0.84	322.39	1.17
6	Truffles,prepared/preserved otherwise than by vinegar/acetic acid	20039010	60,187.00	105.5	0.01	0	0	0	1	0.02
7	Mushrooms prepared/preserved otherwise than by vinegar/acetic acid	20031000	1,49,123.73	176.36	31.83	10.28	10.01	0.1	0.12	0
	Total		**3,21,911.83**	**612.11**	**1037.84**	**52.08**	**1899.06**	**33.77**	**865.75**	**20.88**

Source- Researcher's own compilation of data from APEDA

2.3.2. Export of Mushroom Spawns from India to Various Countries

Export of mushroom in worldwide is not up to the mark as well as export of mushroom spawn is going down and limited with only nearby countries. In the study it is found that (Table. 6) in year 2014-15 India export mushroom spawn more than 6 countries but in year 2019-20 it is limited to 4 nearby countries only.

2.3.3. States Leading in Mushroom Export

Study shows that in last decade from 2011-12 to 2020-21 Delhi is leading in export with total value of ₹385.06 crore followed by Punjab, Uttar Pradesh, Gujarat etc. in table no. 7 top ten exporting states are mentioned.

Table 5: Top 10 Mushroom Exporting States of India from 2011-12 to 2019-20

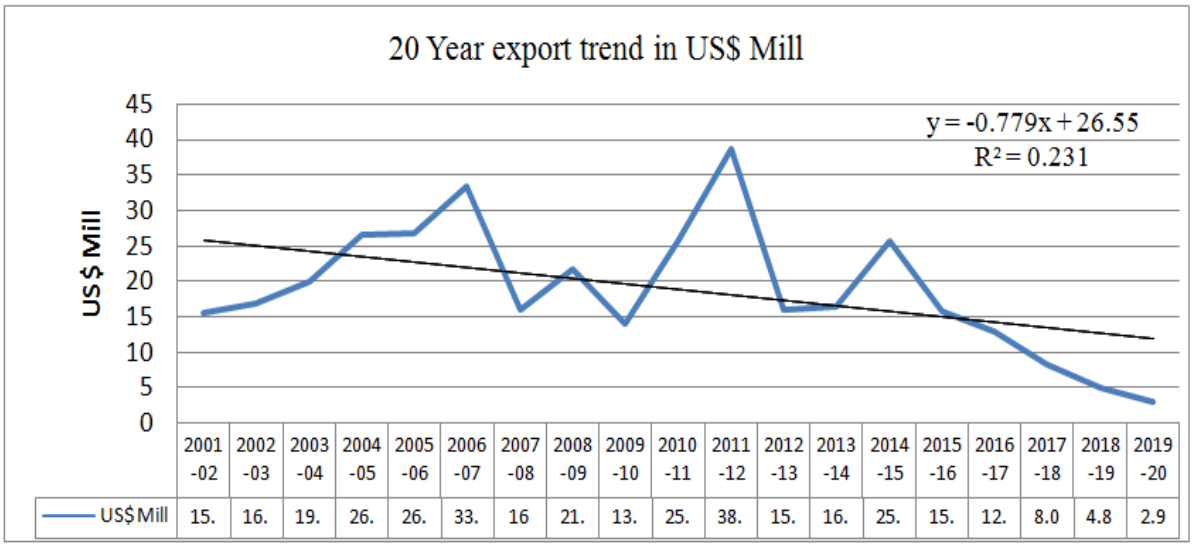
Qty In MT Value in Rs. Crore

	2011-12		2012-13		2013-14		2014-15		2015-16		2016-17		2017-18		2018-19		2019-20		2020-21 (April-August)		Total Value
State	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Qty	Rs. Crore	Rs. Crore
Delhi	46.95	33.39	47.86	27.92	54.02	43.83	74.34	118.6	68.11	76	52.36	47.81	24.4	24.89	9.97	6.43	21.59	4.65	6.05	1.55	385.06
Punjab	19542.57	138	5462.77	35.51	411.42	9.73	408.92	8.7	3.89	5.02	7.87	7.55	2.24	1.84	0.74	1	0.01	0	0	0	207.32
Uttar Pradesh	98.97	9.51	181.84	10.11	191.31	15.39	134.63	11.9	83.87	12.63	73.19	15.55	78.85	14.07	394.56	14.6	390.68	8.86	97.31	4.25	116.87
Gujarat	9.37	0.1	899.26	8.56	1241.47	16.8	308.06	4.04	180.04	3.4	477.3	9	467.21	6.81	373.91	6.49	185.37	3.26	0	0	58.46
Karnataka	98.48	0.45	164.9	1.19	635.33	6.27	1236.8	9.59	462.71	4.75	410.49	5.6	158.3	2.2	147.96	3.07	151.35	3.66	15.8	0.23	37.01
Tamil Nadu	213.32	1	170.84	0.95	801.62	5.53	120.27	0.78	45.39	0.41	41.56	0.55	27.4	0.42	28.17	0.43	1.07	0.01	6.59	0.2	10.28
Telangana	536.8	2.37	180.98	1	204.52	1.05	0.37	0	0.44	0	0	0	17.62	1.26	9.98	0.28	0.4	0.01	0	0	5.97
Maharashtra	13.78	0.1	4.75	0.42	58.6	0.87	145.21	1.57	1.64	0.03	0.51	0.04	21.38	0.39	27.65	0.39	24.18	0.19	10.18	0.09	4.09
West Bengal	0.15	0	0.66	0	0.76	0.01	37.1	0.51	48.41	0.38	0	0	233.53	0.34	876.88	0.91	73.89	0.18	5.86	0.08	2.41
Bihar	0.08	0	0.72	0.02	0.59	0.01	10.02	0.03	2.5	0.03	76.7	0.15	12	0.02	12.4	0.04	16.88	0.07	0.6	0.01	0.38
Total	**20,617.17**	**185.1**	**7,115.29**	**85.69**	**3,599.64**	**99.49**	**2,476.95**	**155.7**	**901**	**102.66**	**1,141.11**	**86.27**	**1,043.39**	**52.24**	**1,901.00**	**33.81**	**871.99**	**20.93**	**143.14**	**6.43**	

Source- Researcher's own compilation of data from APEDA

2.3.4. Edible mushroom export trend

Trend analysis shows that over the past 20 years, mushroom exports have declined and export pattern is not continues due to seasonality in production there is high fluctuation in export and R^2 value is 0.231 which is explaining very less variance indata and the export pattern is not in good condition.



	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
US$ Mill	15.	16.	19.	26.	26.	33.	16	21.	13.	25.	38.	15.	16.	25.	15.	12.	8.0	4.8	2.9

3. METHODOLOGY AND MATERIAL

3.1. The Gravity Model

The gravity model of international business in the international economy is a model that, in its traditional form. Forecasts bilateral trade flows as a function of economic size and distance between two units. Research shows that overwhelming evidence exists that trade tends to shrink with distance.

The model has been empirically successful in accurately predicting trade flows across countries for many goods and services. For many years, however, some scientists felt that there was no theoretical rationale for the gravity equation. However, a gravitational relationship can occur in almost any business model that understands the business costs that grow with distance.

3.2. Methodology and Specification of the Empirical Model

This study looks at the integration of two-way trade between India and major exporting economies. Our data set includes panel data from 1991 to 2019. The dependent variable used in this document is the total mushroom export flows from India. Several researchers suggested using panel data methodology in the estimation of gravitational models to overcome time series and cross-cutting data biases and issues. and panel data econometrics has some basic models- OLS grouped, fixed and randomized affects the models.The gravity model explains international trade flows as a logliner function of receipts and distance between countries. It predicts that bilateral trade depends positively on revenues and is negatively affected by distance. This formulation can be generalized as follows:

$$X_{ij} = \beta_0 Y_i^{\beta 1} Y_j^{\beta 2} D_{ij}^{\beta 3}$$

Where

Xij = The flow of exports to country j of country i

Yi and Yj= Are the GDP of country i and country j

Dij = Geographic distance between the capitals of the countries

$\log (X_{ij}) = \alpha + \beta_1 \log(Y_i) + \beta_2 \log(Y_j) + \beta_3 \log(D_{ij})$

The generalized gravity model of trade shows that the volume of exports between country pairs. Xij, depends on their income (GDP), their population, their distance (indicator of transport costs) and a set of dummy variables that facilitate or restrict trade between two countries.

3.2.1. Model Equations

$$X_{ij} = \beta_0 Y_i^{\beta 1} Y_j^{\beta 2} L_i^{\beta 3} L_j^{\beta 4} D_{ij}^{\beta 5} A_{ij}^{\beta 6} \varepsilon_{ij}$$

$$\text{Ln}\,(X_{ij}) = \alpha + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \ln(L_i) + \beta_4 \ln(L_j) + \beta_5 \ln(D_{ij}) + \beta_2 \ln(A_{ij}) + \varepsilon_{ij}$$

Where,

*Y*i (*Y*j) = GDP of the country *i* (*j*),

*L*i (*L*j)= Populations of the country *i* (*j*),

*D*ij = Distance between the two countries' capitals (or economic canters),

*A*ij= Represents other factors that might affect export flow (mostly, dummy Variables)

*ε*ij= the error term and β_0 are parameters of the model

This study follows the frameworks of the most recent development of the gravitational pattern.This research included the bilateral exchange rate, openness and demographic variable in the severity model and was useful in explaining trade differences between trading partners. Therefore, by inclusion of these variables, our empirical gravity models can be expressed as follows:

$$\ln\text{Export}_{ijt} = \beta_0 + \beta_1 \ln\text{GDP}_{it} + \beta_2 \ln\text{GDP}_{jt} + \beta_3 \ln\text{PCGDP}_{it} + \beta_4 \ln\text{PCGDP}_{jt}$$

$$+ \beta_5 \ln\text{DPCGDP}_{ijt} + \beta_6 \ln \text{Distance} + \beta_7 \ln\text{BEXCH}_{jt}$$

$$+ \beta_8 \ln\text{Openness}_{jt} + \beta_9 \ln\text{POP}_{jt} + \varepsilon_{ijt}$$

Where, the terms of the index i, j and t refer to the exporting country (i.e. India for this study), importing country (i.e. Top economies), and time period respectively. $\beta 0$ and βs Specifies the intercept term by country and the estimated coefficients. Export_{ijt} refers to the total value of bilateral exports between country i and country j. GDP_{it} (GDP_{jt}) is Gross Domestic Product (GDP) in millions of US dollars of country *i* (*j*), and $PCGDP_{it}$($PCGDP_{jt}$) represent Per Capita GDP of country *i* (*j*), while $DPCGDP_{ijt}$ is the absolute difference value between GDP per capita of country *i* and *j*. The distance denotes the geographical distance (in km) between the capital of country i (New Delhi, India) and the capital of j.The distance denotes the geographical distance (in km) between the capital of country i (New Delhi, India) and the capital of j. BEXCH_{jt} is the bilateral exchange rate of the currency of country j in relation to the five currencies of country i (USD) at time t. Openness corresponds to the level of openness of the country's trade in time t. The POP_{jt} represents the population of the top exporting countries at time t, *ε*ijt is an error term.

Thus, this study's Empirical Gravity Models are expressed as follows:

$$\text{Model I} \quad \ln Export_{ijt} = \beta_0 + \beta_1 \ln Export_{ij,t-1} + \beta_2 \ln(GDP_{it}.\ GDP_{jt}) + \beta_3 \ln Distance + \beta_4 \ln BEXCH_{jt} + \beta_5 \ln Openness_{jt} + \beta_6 \ln POP_{jt} + \varepsilon_{ijt}$$

$$\text{Model II} \quad \ln Export_{ijt} = \beta_0 + \beta_1 \ln Export_{ij,t-1} + \beta_2 \ln(PCGDP_{it}\ .\ PCGDP_{jt}) + \beta_3 \ln Distance + \beta_4 \ln BEXCH_{jt} + \beta_5 \ln Openness_{jt} + \beta_6 \ln POP_{jt} + \varepsilon_{ijt}$$

$$\text{Model III} \quad \ln Export_{ijt} = \beta_0 + \beta_1 \ln Export_{ij,t-1} + \beta_2 \ln DPCGDP_{ijt} + \beta_3 \ln Distance + \beta_4 \ln BEXCH_{jt} + \beta_5 \ln Openness_{jt} + \beta_6 \ln POP_{jt} + \varepsilon_{ijt}$$

According to the theoretical design of the gravity model. Economic size and income (GDP per capita) should have a positive impact on trade flows and promote trade between India and major exporting countries. The third level of income has an ambiguous effect. The coefficient may have a positive sign, if countries have the configuration of bilateral trade Heckscher-Ohlin (H-O), while the negative sign of this variable may appear in the Linder hypothesis.The bilateral exchange rate coefficient of j against Indian rupiah should be negative. (for example, any increase in the currency of the exporting country compared to the Indian rupee to decrease trade flows between India and major exporting economies). The more open the country's economy is, the more trade will come in. So the positive sign of an open economy has been ignored.For the population, MartínezZarzoso and Nowak-Lehmann (2003) emphasize that the population ratio can be either negative or positive, depending upon whether the country exports less when it is large (absorption effect) or whether a large country exports more than a small country (economies of scale).

In case of variable(s) invariant in time, we expect a negative sign for the distance, because it is the approximate cost of transportation. The longer the distance between partners leads to higher transport costs.

4. RESULTS AND DISCUSSIONS

4.1. Panel Unit Roots Test

Before estimating empirical equations, these paper analyses univariate features of the data that involve the root test of the panel unit. The root test of the panel unit identifies a possible co-integration relation among the variables. If all variables do not have a unit root, i.e., are stationary, traditional estimation methods may be used to estimate the relationship between the variables. Whether the variables have a unitary root test, i.e. no stationary, a co-integration test will be conducted.There are many different types of root panel unit test, and the most common used for the root unit test approach in the output literatures is the Levin-Lin-Chu (LLC) test. As a result, in this document, the LLC test was also applied to the panel root test at both the level and the first difference. This methodology is based on the assumption that self-regulatory parameters are common across countries. The null hypothesis of the root unit is used for the LLC method.At Level, we found 4 significant variables include ln Export $_{ijt}$, ln GDP_{jt}, ln DPCGDP $_{ijt}$, (significant at 5%) and ln$BEXCH_{jt}$ (significant at 1%), while all other 5 variables (ln Export $_{ij,t-1}$, lnGDP_{it}, ln PCGDP $_{it}$, ln PCGDP $_{jt}$, and ln PCGDP $_{jt}$,) are strongly significant at 1% at First Difference. We conducted a panel review of India's trade with the top five exporting economies.

Table 6: Levin-Lin-Chu (LLC) Unit Roots Test

Levin-Lin-Chu (LLC) Unit Roots Test Result					
Level	**LLC**	**P-Value**	**1st Diffrence**	**LLC**	**P-Value**
ln Export $_{ijt}$	-2.28665**	0.011	ln Export $_{ijt*}$	-9.60995	0.000
ln Export $_{ij,t-1}$	0.116981	0.547	ln Export $_{ij,t-1*}$	-9.75684***	0.000
$lnGDP_{it}$	2.134344	0.984	$lnGDP_{it*}$	-9.01907***	0.000
ln GDP $_{jt}$	-2.12927**	0.017	ln GDP $_{jt*}$	-7.2267	0.000
ln PCGDP $_{it}$	4.91293	1.000	ln PCGDP $_{it*}$	-8.31293***	0.000
ln PCGDP $_{jt}$	-1.32402	0.093	ln PCGDP $_{jt*}$	-7.51377***	0.000
ln $DPCGDP_{ijt}$	-1.68154**	0.046	ln DPCGDP $_{ijt*}$	-7.50794	0.000
$lnBEXCH_{jt}$	-2.26949***	0.012	$lnBEXCH_{jt*}$	-9.79452	0.000
$lnPOP_{jt}$	-3.52959	0.000	$lnPOP_{jt*}$	-1.05622	0.045
ln Openness $_{jt}$	-1.95783	0.025	ln Openness $_{jt*}$	-10.7137	0.000
ln WTO $_{it}$	-1.62247	0.042	ln WTO $_{it*}$	-4.3032***	0.000

Note: (*) in the variable name, indicate the first difference of the variable, (*, **, ***) in the CLL result, indicates that the CLL test is meaningful at 10%, 5% and 1%.

4.2. Gravity Model Estimation

As well, we have a fixed-effect model. We found that GDP and income.(GDP per capita) of the large exporting economies show a negative sign of the trade integration of the large exporting countries in India. But the results point to a negative sign in the random effect pattern. This finding indicates that India tends to export more to major economies as wellthe USA, France, Germany, rather than bigger economies, like Switzerland (GDP per capita of Switzerland is higher than other economies).However, we found no significant results in terms of GDP and revenues of India's major exporting economies. The large exporting countries recorded a significant positive opening factor. This suggests that the level of openness of major exporting economies is statistically different from each other. , which has a significant effect on the exports of the largest exporting countries in India. In the case of GDP, the result shows that an increase of 1% of India's GDP would increase the volume of bilateral trade by around 2.1%. Likewise, the results predict that bilateral trade between India and key economies could be boosted by around 2.4% with a 1% increase in GDP per capita. As well, the effect of the difference in revenues (DPCGDP). Trade is positive, indicating a 1% increase in the PDCGDP, which translates to a 12% increase in the volume of bilateral trade between India and key exporting economies. The results from the three models show a marked positive impact (significant 1%) on the bilateral exchange rate and the population size of the major exporting economies. An increase of 1 percent in the bilateral exchange rate and the population size of major economies increases India's trade export flow. leading exporting economies, an average of 0.5% and 10.8% (for the fixed effect model) or 14.9% (for the random effect). Martinez-Zarzoso and Nowak-Lehmann (2003) found that the population coefficient of the major economies in this study showed positive signs. The largest economies tend to export less as their population increases (rather than economies of scale). As a consequence, the main economies tend to increase the volume of imports from India (i.e. India’s export increased).

Finally, distance as an indicator of transportation costs, which predicts that the more transportation costs, the less trade between countries, also has positive signs of influence across the three random effect models. In our empirical model, we also revealed only 1% increasing distance would increase bilateral trade by an average of 1.3% between India and the five largest exporting economies.

Table 7: Gravity Model Estimation

ln Export ijt	Model 1				Model 2				Model 3			
	Fixed Effect		Randome Effect		Fixed Effect		Randome Effect		Fixed Effect		Randome Effect	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
ln Export ij,t-1	0.451	0.000	0.000	0.008	0.446	0.000	0.000	0.011	0.000	0.001	0.000	0.001
lnGDPit	-2.584	0.125	-2.665	0.156								
ln GDP jt	-2.096	0.743	-3.970	0.566								
ln PCGDP it					-3.201	0.109	-3.614	0.104				
ln PCGDP jt					-2.397	0.700	-3.721	0.578				
ln DPCGDP ijt									-11.970	0.047	-8.647	0.128
lnBEXCHjt	0.527	0.635	1.765	0.152	0.583	0.588	1.713	0.151	2.788	0.005	2.986	0.003
lnPOPjt	10.768	0.195	14.924	0.083	8.763	0.020	11.078	0.002	12.620	0.002	9.252	0.008
ln Distance jt			1.600	.264			1.362	.320			1.128	.318
ln Openness jt	3.660	0.003	5.234	0.000	3.569	0.003	5.185	0.000	4.393	0.000	4.337	0.000
Constant	-94.597	0.080	-122.313	0.036	-141.119	0.036	-175.611	0.013	-126.317	0.036	-101.427	0.087
No.of Groups	5		5		5		5		5		5	
No. of Observation	145		145		145		145		145		145	
R^2	0.586		0.314		0.587		0.317		0.493		0.297	

Table 7 presents the overall R-squares of the three fixed effect models at 58%, and for random effect models, R-squares are greater than 32%. Which means our models fit the data fairly well. In addition, in order to differentiate between the fixed and random effects test, the Hausman test was applied. The null hypothesis of the Hausman test suggests that the random effect model is more efficient than the fixed effect model. The findings in Table 7 indicate that the Hausman specification test rejects the null hypothesis. This suggests the model with a fixed impact is preferable. Given that the steady-state model is the appropriate model, interpretation of the results will focus on the steady-state model.

4.3. Second- stage regression: Fixed effects regressed on dummy

Table 8: Second- Stage Regression: Fixed Effects Regressed on Dummy

ln Export ijt	Model 1		Model 2		Model 3	
	Fixed Effect		Fixed Effect		Fixed Effect	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
ln Export ij,t-1	**0.436**	**0.000**	**0.435**	**0.000**	**0.454**	**0.000**
lnGDPit	**-1.739**	**0.315**				
ln GDP jt	**-5.488**	**0.408**				
ln PCGDP it			**-2.005**	**0.338**		
ln PCGDP jt			**-5.884**	**0.366**		
ln DPCGDP ijt					**-9.479**	**0.089**
lnBEXCHjt	**1.142**	**0.322**	**1.213**	**0.283**	**1.907**	**0.038**
lnPOPjt	**14.179**	**0.094**	**8.678**	**0.021**	**7.584**	**0.034**

ln Distance jt	**-2.770**	**.606**	**.666**	**.679**	**.126**	**.970**
ln Openness jt	**1.367**	**0.072**	**3.202**	**0.007**	**2.693**	**0.012**
ln WTO it	**39.481**	**0.009**	**1.326**	**0.087**	**1.617**	**0.028**
Constant	**-96.442**	**0.106**	**-124.762**	**0.096**	**-69.842**	**0.230**
No.of Groups	**5**		**5**		**5**	
No. of Observation	**145**		**145**		**145**	
R^2	**0.596**		**0.596**		**0.593**	

We have also included India's WTO membership in our second model with a fixed effect. Since its accession to the WTO in January 1995, India has become a major player in the world trading system. The result on fixed effects decreased on the model shows that the accession of India to the WTO has a major impact on bilateral export flows. The total R squares of the three fixed effect models achieve 60%.

5. CONCLUSIONS

This study aims to explore the key determinants that influence Indian mushroom exports to major exporting countries. We noted a gap in the current literature on India's economic integration into large exporting economies. According to the nature and availability of the data, we opted for 29 years from 1991 to 2019. Global and regional economic integration is on a declining trend. After the world economic crisis of 2007, India experienced a slowdown in economic growth. Economists call it a normal new growth in the economy.Trade between India and major exporting economies is interconnected and maintains a strong historic relationship of economic cooperation. The principle of comparative advantage might focus on the fundamental premise of cooperation. In this study, we used the signal severity model to identify the major drivers of regional economic integration. The results showed that GDP, GDP per capita, openness, bilateral exchange rate and population negatively affect bilateral exports, while distance is not a barrier to trade. India's accession has a significant impact on India's bilateral exports to the main exporting economies. India has not been shown to be well integrated in the major exporting economies. The limitations of the data were reviewed. There are a number of unobserved factors, including border disputes, tariffs, prices, import substitution policy, language and policy.Variables that could have a significant impact on the trade relationship between India and key exporting economies. Further research is required to explore new factors that could enhance the export picture with larger datasets. In addition, the potential researcher could concentrate on estimating import and export parameters separately.To overcome the problem of diminishing the export potential of mushroom in the main exporting countries. It was suggested that India should increase its exports with the aim of achieving economies of scale.

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